Pictorial Compilation of Complications after Vertebral Augmentation for Pathologic Fractures in the Cancer Patient

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Introduction

Vertebral compression fractures (VCF) are a major cause of morbidity in patients suffering from cancer. Approximately 10% of all cancer patients will have symptoms related to VCF. The most common symptom, pain, can be debilitating and have devastating effects on the patient's physical functioning and quality of life. The treatment of choice for these fractures is vertebral augmentation (kyphoplasty, vertebroplasty). The benefits of vertebral augmentation have been empirically supported, with consistent findings of reduction in pain and disability, improved quality of life, and decreased analgesic use. Despite these positive findings, there are inherent risks for complication. The aim of this study is to illustrate complications related to vertebral augmentation procedures seen in a tertiary care cancer hospital setting.

Methods

Review of all cases performed by or presenting to the pain service in the last twelve months, identifying those that would best represent on imaging complications associated with vertebral augmentation procedures.

Results & Discussion

We identified six cases that highlight notable complications from vertebroplasty or kyphoplasty. Although the complication rate from vertebral augmentation is relatively low, it is higher in those suffering from cancer-related fractures. The most common complications include cement leakage, which can occur into the spinal canal, neural foramina (**Fig.1**); paravertebral tissues, epidural space (**Fig.2**); vascular system (**Fig.6**). Although the majority of these leaks are asymptomatic, a significant leak into the spinal canal or foramina can lead to worsening pain, radiculopathy or spinal cord compression. Embolization of the cement can also occur (pulmonary embolus, **Fig.5**), many of these remain asymptomatic but death has been reported in at least 3 cases. Cement leakage is less likely to occur in fractures with vacuum or cystic changes, as the presence of a cavity promotes more homogenous and controlled filling of the fractured vertebral body – similar to cement deposition in balloon kyphoplasty. Therefore, when avascular necrosis is present, it may serve as a protective factor against cement leakage and mitigate the need to use balloon kyphoplasty. Although VCF treated with kyphoplasty are less likely to have cement extravasation than vertebroplasty, the cost of the procedure is about 2.5x more expensive. The two procedures have similar long-term improvement in pain and disability and similar safety and device-related complications, making appropriate patient selection paramount for resource utilization. Additionally, there are reports of epidural abscess development after vertebral augmentation (**Fig. 3**). This can be a potentially disastrous complication resulting in severe neurological deficits. Fortunately, surgical intervention with spinal decompression or abscess drainage and treatment with IV antibiotics can prevent permanent impairments. Balloon rupture during kyphoplasty (**Fig. 4**) can also occur, with the majority of fragments remaining within the vertebral body, remaining asymptomatic. Rupture may be precipitated by sharp solid bone fragments, and may be avoided by slowly increasing balloon inflation pressures allowing the shape of the balloon to adapt to the solid and sharp bony environment.

Conclusion

Vertebral augmentation for pathologic compression fracture may result in a variety of potential complications with varying clinical sequelae.

References

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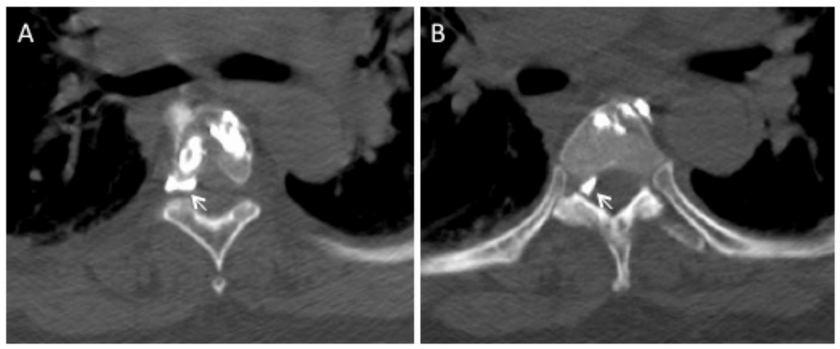

Figure 1. Spinal canal and foraminal cement extravasation. Axial CT at T5 demonstrate cement extravasation into right neural foramen (arrow, A) and right lateral epidural space (arrow, B)

Figure 2. Perivertebral cement extravasation. Axial CT (A), Sagittal (B) showing cement extravasation with T7-T9 vertebral augmentation (epidural extravasation, arrows; asterisks show prevertebral extravasation, A&B)

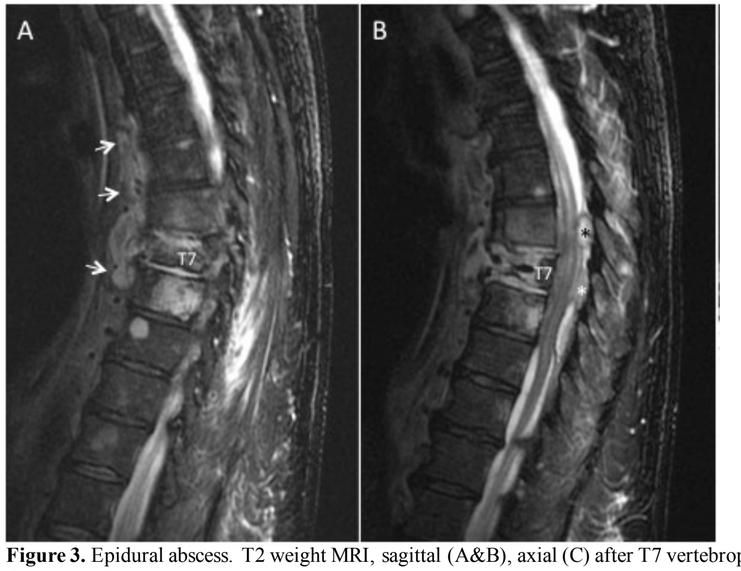

Figure 3. Epidural abscess. T2 weight MRI, sagittal (A&B), axial (C) after T7 vertebroplasty. Prevertebral inflammation T4-T8 (arrow, A), posterior epidural abscess collection T6-T7 (asterisks, B&C).

Figure 4. Rupture of inflatable bone tamp (balloon) during kyphoplasty. Fragment of balloon with radiopaque marker (arrow) within vertebral body.

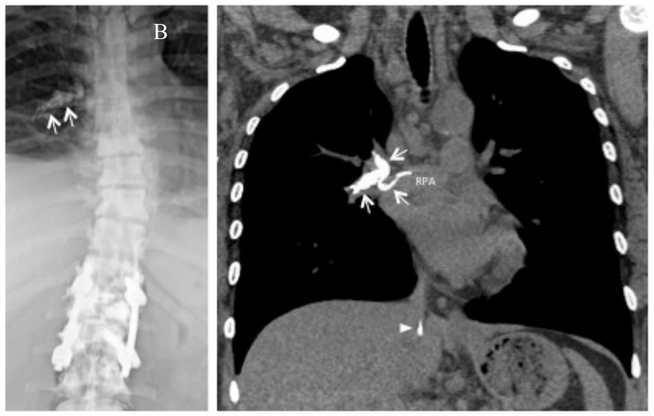

Figure 5. Pulmonary cement emboli. AP radiograph of thoracic spine (A) Coronal CT of thorax (B), show cement emboli (arrows, A&B) clumped in the right pulmonary artery (RPA), cement also in IVC (arrowhead, B)

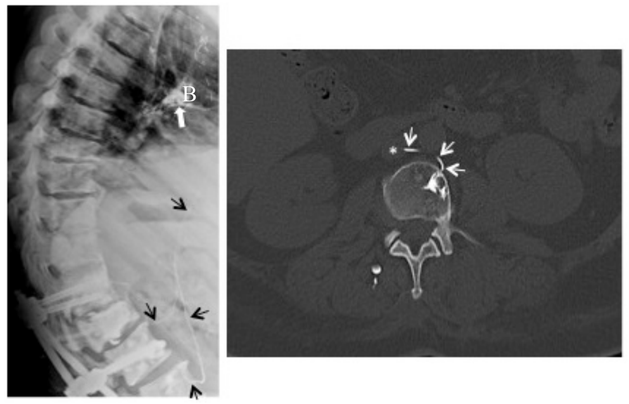

Figure 6. Vascular cement extravasation. Lateral radiograph of thoracic spine (A) and axial CT at L3 (B) after posterior spinal fusion T12-L2 and vertebroplasty T12-L3. Cement extrusion from L2-L3 into the IVC (thin arrows, A), cement clumped in the pulmonary artery (thick arrow, A). Cement extrusion from the vertebral body into adjacent veins (arrows, B) and then into IVC (asterisk, B).